Medicare Participating Heart Bypass Center Demonstration

HCFA
Office of Research and Demonstrations

Extramural Research Report

Health Care Financing

Extramural Research Report

The Office of Research and Demonstrations, Health Care Financing Administration, directs more than 300 intramural and extramural research, demonstration, and evaluation projects. These projects seek alternate ways to finance, organize, and deliver health services and assess the impact of Federal programs on health care costs, provider, and beneficiaries. The Health Care Financing *Extramural Research Report* series represents the final reports from selected extramural projects funded by the Office of Research and Demonstrations. The statements and data contained in each report are solely those of the awardee and do not express any official opinion of or endorsement by the Health Care Financing Administration.

Medicare Participating Heart Bypass Center Demonstration evaluates the impact of one of the Health Care Financing Administration's cost containment demonstrations. The report summarizes a project undertaken by the evaluation contractors, Lewin-VHI and Health Economics Research.

The Office of Research and Demonstrations implemented the Medicare Participating Heart Bypass Center demonstration to test the feasibility and cost effectiveness of a negotiated package price for coronary artery bypass graft (CABG) surgery. The goal of the demonstration was to assess the feasibility of a negotiated all-inclusive pricing arrangement for CABG procedures while maintaining high-quality care. Under the demonstration, hospitals and physicians participating in the demonstration received a global payment covering hospital and related physician services for CABG surgery. Participating providers, both hospitals and physicians, accepted the negotiated global rate as payment in full. The demonstration realized cost efficiencies through coordination of services and increased volume that allowed the centers to provide a discount to Medicare.

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Background and Rationale for the Demonstration

In 1980, the federal government spent $36.4 billion on the Medicare program (Letsch *et al.*, 1992). By 1991, the figure had reached $120.2 billion, an average increase of 11.4 percent annually. For hospital care alone, the federal Medicare Program spent $26.4 billion in 1980 versus $73.3 billion in 1991 (Letsch *et al.*, 1992). Spending on physician services rose even faster from $7.9 billion in 1980 to $32.8 billion in 1991.

The Health Care Financing Administration has been very active in responding to these high rates of program outlays. On the hospital side, the Congress passed TEFRA legislation in 1982 that put per case ceilings on hospital reimbursements. Then, a year later, it passed DRG prospective payment for all short-term acute hospitals receiving Medicare payments. In terms of physician reimbursement, the Congress passed, and HCFA implemented, the physician fee freeze in the mid-1980s, followed by overpriced procedure rollbacks in the late 1980s, and, finally, the Medicare Fee Schedule in the early 1990s designed to link payments more closely to work effort and the costs of each service.

Besides legislated reform, HCFA also has undertaken many cost containment demonstrations. One approach involved negotiating global payment rates for all Part A and B inpatient services associated with bypass surgery. Expenditures on heart bypass surgery have been particularly worrisome. Every year, the government spends several billion dollars on the inpatient care for bypass patients. Outlays continued to grow rapidly in the 1980s with the growth in procedure rates. With the implementation of DRG per case payment to hospitals in 1983, the Part A payment per case for bypass surgery has been capped at the annual update in Medicare hospital rates nationally. However, the growth in Part B physician outlays remained unconstrained, except for rollbacks on the surgeon's fee. Mitchell (1993) estimates that total allowed charges grew 12-14 percent for bypass surgery from 1985-88, even after adjusting for updates in allowable fees.

A major concern of both hospital managers and policy makers in controlling inpatient costs for high-tech procedures is the asymmetry of financial incentives faced by hospital staff versus physicians. Currently, hospitals are paid for bypass surgery on a per case basis (primarily within DRGs 106 and 107). Except for extraordinary outlier costs, they are paid a fixed amount regardless of the intensity of care provided each patient. Although surgeons, like hospitals, receive a bundled fee for inpatient services, other physicians, by contrast, are paid for every additional service they provide, including routine daily hospital visits and consultations. Surgeons, too, are paid more for more complicated surgeries requiring more bypassed lesions. Moreover, all hospital services are essentially "free" to physicians because they bear none of the financial risk of keeping patients in the ICU longer, or using more expensive drugs, etc. So long as physicians operate under different payment incentives, hospital managers have had difficulties implementing more efficient practice patterns. A global fee that includes physician services would align incentives and encourage physicians to use institutional resources in a more cost effective manner.

Overview of Demonstration Design

In 1988, the Health Care Financing Administration solicited bids from hospitals and physicians to participate in the Medicare Heart Bypass Demonstration. After initial review, 42 hospitals were requested to submit extensive formal applications that detailed their qualifications and bypass volumes. Applicants were then asked to give their best price covering all inpatient institutional and physician services for Medicare patients discharged in DRGs 106

and 107, bypass with or without catheterization. Twenty-seven entities submitted bids, and an expert panel of physicians reduced the list to ten finalists. At this point, Agency staff, with the assistance of staff from Lewin-VHI and Health Economics Research, the evaluation contractors, conducted an in-depth evaluation of each proposal. Ten criteria were used to rank applicants based on quality and price considerations. The Agency then negotiated contracts with four applicants:

- St. Joseph's Hospital in Atlanta;
- St. Joseph's Mercy Hospital in Ann Arbor;
- Ohio State University Hospital in Columbus;
- University Hospital in Boston.

These sites were chosen based on price and other factors, including geographic dispersion. The intent was to maximize the policy information derived from the novel payment arrangement as well as to test the feasibility of negotiating and then paying bundled global rates.

Under the demonstration, Medicare paid each of these applicants a single global rate for each discharge in DRGs 106 and 107. This rate included all inpatient hospital and physician services. The standard Medicare hospital passthroughs were also included, i.e., capital and direct medical education, on a prorated basis. Any related readmissions were also included in the rate. Pre- and post-discharge physician services were excluded except for the standard inclusions in the surgeon's global fee. All four participants agreed to forego any outlier payments for particularly expensive cases.

Hospitals began receiving payments in May and June of 1991. The length of demonstration was set at three years, ending in June of 1994. Participants were required to assemble all physician bills along with the hospital discharge abstract and submit the package to HCFA Central Office for payment. The hospital and physicians were free to divide up the payment any way they chose. Rates were updated annually according to existing hospital prospective payment and physician fee schedule rules.

Applicants were required to collect a predetermined financial obligation from Medicare patients. This included any Part A hospital and Part B physician deductibles plus the 20 percent Part B coinsurance. Ordinarily, the coinsurance amount varies by the amount of physician services each patient receives, but under the demonstration the Agency set a fixed actuarial amount per discharge to conform to the (estimated) negotiated Part B amount.

The government placed few requirements on participants other than those already imposed by the program. Hospitals were still subject to the usual utilization review activities that monitored necessity for admission. Physicians were not allowed to balance bill patients, nor could they bill for outpatient services normally included in their global inpatient fee. When the Agency reclassified most DRG 108 bypass patients back into DRGs 106 and 107 in 1992, these patients became part of the demonstration as well. Similarly, when the Congress passed the Medicare Fee Schedule that rolled back many surgical fees, the Agency made downward adjustments in the Part B component of the global rates.

Unlike the current Medicare program, the Agency required that it have the right to review and approve any promotional materials used by the hospitals and physicians under the demonstration. One of the marketing strategies proposed by applicants was to forego the deductible and copayments for patients without supplemental insurance. The Agency finally ruled against this request on the grounds that it would discriminate against third-part insurers (and their subscribers) who would still be liable. Providers were not willing to forego deductibles and copayments on all demonstration patients.

In the spring of 1993, the government expanded the demonstration to include three more participants:

- St. Luke's Hospital in Houston;
- St. Vincent's Hospital in Portland, Oregon;
- Methodist Hospital in Indianapolis.

All six of the remaining ten applicants from the first round were invited to submit new bids, but only St. Luke's, St. Vincent's, and Methodist Hospital did so. These hospitals began receiving payments in the second quarter of 1993 under three-year contracts. The original four hospitals all agreed to continue being paid global rates under the demonstration after their contracts ended in the summer of 1994.

Evaluation Issues

Many issues were addressed in the evaluation. Some of the more important ones included:

Feasibility

Was it possible for the government to negotiate discounts with providers that included both hospital and physician services? Could this process be fair and efficient? What data and other requirements were required on the government's part? On the provider side, would any hospitals and physicians be able to work together and submit a single packaged rate? Could they provide the data necessary for the government to evaluate the quality of their services and the extent of the discounts they were offering?

Implementation

In order to begin paying global rates, what payment processes had to be changed? What requirements would providers have to meet for payment? How should demonstration billings and payments be integrated with the on-going systems of Fiscal Intermediaries and Carriers? How should the patient obligations be determined? How would changes in Medicare payment policies be applied to the demonstration? What kinds of routine reporting by participants would be required?

Volume Growth

Did the imprimatur of being named a Medicare Participating Heart Bypass Center result in increased bypass volumes among the participants? How did participants promote the demonstration? Did they increase volume at the expense of local competitors? How did competitors react to the demonstration?

Program, Beneficiary, and Hospital Savings

How large were the discounts that the government negotiated with participants? How much did Medicare beneficiaries (and their insurers) benefit as a result of the discounts? Did post-discharge utilization and costs change as a result of bundling all inpatient physician services into a single rate? Did any gains in market shares of demonstration hospitals result in further program savings at the market level? By aligning physician with hospital incentives under a per case payment, did practice patterns change that generated lower hospital costs?

Patient Outcomes

Did patient outcomes change under the demonstration, as measured by inpatient mortality and complication rates? Did one-year post-discharge outcomes change, as measured by mortality, angina relief, and readmissions? Were there any systematic differences in outcomes among participants?

Appropriateness of Care

Did the overall level of appropriateness of care change under the demonstration? If so, did the changes vary by clinical presentation, i.e., stable vs. unstable angina, acute myocardial infarction? What was the extent of disease among demonstration patients and how did that change over the demonstration period?

Patient and Hospital Management

Did physicians change the way in which they managed patients in the hospital under the demonstration? Were there changes in

ICU, surgery, catheter lab, pharmacy, and routine nursing services? Were there any changes in the use of consulting physicians under a single fixed global payment? Did hospitals introduce significant management changes to lower costs and improve service efficiency over-and-above changes in patient management?

Marketing Programs

How did participants market their selection as a demonstration hospital? Did they employ different strategies towards patients, referring physicians, and insurers? Were participants in a better position to compete for managed care contracts because of the demonstration? What impacts did marketing have on volumes? How did competitors respond in their marketing efforts?

Physician Payments

Once the hospital received the bundled payment, how was it divided up between the institution and physicians? How were consulting physicians that were not routinely involved in a case reimbursed? Did physicians share in any of the cost savings that may have resulted from changes in their practice patterns? What impact did the Medicare Fee Schedule rollbacks on certain bypass-related procedures have on physician payments?

Reimbursement Difficulties

What problems did participants encounter in receiving payment from the government? What problems did they encounter in billing third-party payers for the supplemental insurance?

Achievement of Goals

How satisfied were hospitals and physicians with the demonstration? Did they feel that the demonstration helped them gain volume and market share? Did it force them to improve their patient and cost reporting for management purposes? Did they feel that the alignment of incentives led to significant improvements in hospital and patient management? Did they believe that the demonstration resulted in a closer working relationship between the hospital and clinical staffs? Were participants disappointed with any aspect of the demonstration?

Evaluation Approach

To provide answers to these questions, the Health Care Financing Administration contracted with Lewin-VHI and Health Economics Research. Their interdisciplinary staff of economists, physicians, and marketing experts were responsible for assembling a variety of data bases and conducting numerous on-site interviews with participants as part of an extensive quantitative and subjective evaluation of the program. The staff also assisted HCFA in the evaluation of the bids of the ten finalists.

The principal data bases used in the evaluation included:

- all MedPAR discharge records for DRGs 106, 107, and 108 for four years, 1990-93;
- all National Claims History Part B claims for patients identified on the MedPAR files;
- detailed hospital micro-cost information on each patient;
- detailed clinical information on each demonstration patient;
- follow-up patient outcome status one year post-discharge;
- the Medicare enrollment file information on all demonstration patients;
- angiographic films and reports for a sample of 120 patients in six sites;
- detailed patient volumes, marketing, and referral information from all seven sites.

The Medicare claims were used to document national trends in Medicare bypass volumes, patient demographics, lengths of stay, mortality rates, and costs. Trends were decomposed by hospital location, teaching status, and bedsize. Physician costs were decomposed

into three segments representing 30 days prior to bypass surgery, inpatient, and 90 days post-discharge. Inpatient physician costs were further separated by specialty. Finally, national Medicare bypass expenditure regressions were used to isolate the trend and hospital and patient factors explaining the variation in hospital DRG and hospital plus Part B physician expenditures.

When subsetted to the demonstration hospitals and their competitors in local markets, the claims data supported quantitative analyses of shifts in market shares and comparative differences in patient demographic mix, costs, and lengths of stay. These analyses involved statistical tests of the differences in shares and other characteristics between 1990, the baseline year, and 1993, the last year of the original demonstration.

The Part A and B claims data, along with the negotiated global prices provided by HCFA, were also used to measure the extent of program and beneficiary savings under the demonstration. Negotiated prices were compared with predicted Medicare prospective payment rates and physician inpatient outlays to derive the immediate savings from the demonstration. To test for shifts in services post-discharge, the other claims associated with demonstration patients 30-days prior and 90-days post-discharge were compared, year-by-year, with what might have been expected in lieu of the demonstration, based on 1990 average outpatient payments at each demonstration hospital updated by the national growth in outlays for the same two pre- and post-discharge "windows". Finally, any market share savings were derived by taking the difference between the negotiated prices and what other competitors were being paid by Medicare and multiplying by the shift in cases.

The micro-cost information was used to evaluate trends in institutional costs and profits on demonstration patients. Each of the four original participants submitted cost data on each patient by individual service and/or by department for a baseline 1990 period and for the 1991-93 demonstration period. Average total and variable costs were derived, then compared, showing overall gains in costliness and profits per case. Per case costs, within DRG, were also decomposed by department to isolate the source of any efficiency gains.

Every demonstration hospital provided a set of clinical information on each patient, including discharge status (died, other), risk indicators, comorbid conditions, admission priority, type of coronary heart disease, age, gender, height, whether they had had a previous bypass operation, and ejection fraction. Additional information was provided on disease anatomy, e.g., number of lesions, percent occlusion by lesion, and intra- and post-operative complications, e.g., return to the operating room for bleeding, infection. Extensive descriptive analyses were performed comparing the seven hospitals in terms of mortality, stratified by risk factor and other relevant variables. Logistic analyses were then conducted explaining inpatient mortality, complication rates, and lengths of stay. The demonstration effect was tested in these models using a monthly time trend over the demonstration period. The mortality analyses were extended to 90-day and one-year follow-up using the Medicare enrollment files that record dates of death that may have occurred after discharge.

To test for any changes in the appropriateness of bypass surgery, a special panel of clinical experts was convened to rate the appropriateness of bypass surgery along several dimensions, including clinical presentation, surgical risk, number and type of arterial vessels occluded, extent of drug therapy, and ejection fraction. These ratings were merged onto the clinical data base according to each patient's mix of appropriateness criteria. Descriptive and multivariate analyses were then performed testing the change in appropriateness ratings depending upon the period in which the patient was

discharged.

Appropriateness depends in part on the degree of vessel stenosis, or blockage. A concern over systematic differences in physician interpretations of the degree of stenosis resulted in a methodological study in which six of seven demonstration hospitals voluntarily submitted 20 films and angiographic reports for reinterpretation by an expert investigator. Again, descriptive and multivariate analyses were performed on over 300 lesions reported for the 120 patients using either the visual or computer-generated differences between the hospital and the expert as the dependent variable.

How successful hospitals were at marketing the program was determined by collecting detailed information from each site on their Medicare and non-Medicare bypass volumes. Data was also gathered on the location of patients and referring physicians. Descriptive analyses of trends over time in volumes and shifts in referrals were then conducted.

In addition to the quantitative analyses using primary and secondary data, a single team of three evaluators visited all seven sites once and the four original sites a second time for in-depth interviews with managers and clinical staffs. These interviews were designed to fill in the gaps and help explain the results of the quantitative analyses. Interviews were conducted with hospital CEOs, COOs, CFOs, demonstration managers, department managers, marketing and managed care directors, billing/collection personnel, micro-cost data managers, operating room and floor nurses, and utilization review and quality of care directors. Interviews were also conducted with thoracic surgeons, cardiologists, anesthesiologists, catheter lab clinicians, and other consulting physicians. Questions regarding operational changes were asked of each respondent and whether they were the result of participating in the demonstration. Respondents were also asked why they decided to participate, how successful the demonstration had been, and what problems were encountered.

To supplement the interviews in the demonstration hospitals, interviews were conducted in two competitor hospitals with managers and physicians. (Attempts to interview in the two other original sites were unsuccessful.) These interviews focused on marketing and competitive issues.

Summary of Findings

National Trends in Medicare Bypass Surgery

After rising steadily for twenty years, the number of Medicare heart bypass cases appears to have peaked at 150,000 in 1992, before declining slightly in 1993. Over the four-year period, 1990-93, total Medicare program costs on bypass surgery alone increased by roughly $1 billion to $5.5 billion by 1993. This estimate includes not only an extra $870 million in hospital payments, but a 50 percent increase in 90-day post-discharge outlays as well. Home health and skilled nursing costs either doubled or tripled over the period.

National Medicare inpatient mortality rates fell from 1990 through 1993 by one percentage point to 5.5 percent in 1993. Rates were 1.5 points higher in small (under-200 bed) hospitals. Significant differences in inpatient mortality rates exist across hospitals more generally. Ten percent of the roughly 800 bypass hospitals have mortality rates less than 2 percent versus another 10 percent with rates above 9.5 percent. Hence, the issues of quality and regionalization of bypass surgery in larger hospitals provide a strong motivation for the demonstration.

Substantial reductions in inpatient stays also took place while mortality rates were falling. As recently as 1990, the average bypass stay was 15 days. Three years later, it had fallen to 12.5 days. Yet, as with mortality rates, significant variation in lengths of stay of nearly a

week remained between the top and bottom 10 percent of hospitals.

Despite shorter stays, Medicare outlays per case for bypass surgery, including a 90-day post-discharge follow-up period, rose 7.2 percent over three years to $37,400. Inpatient costs, including associated physician services, rose $1,500 to $30,905; post-discharge costs rose by $900. When hospital location, size, and patient age and gender are controlled for, surgery in major teaching hospitals cost the government almost $9,000 more than in non-teaching hospitals, including both institutional and physician bills.

Feasibility of Bundled Payment

The federal government received almost 200 letters of interest to its initial request for bids to bundle both Medicare Part A hospital and Part B physician services. Forty-two qualified bidders were requested to apply; 27 responded with full bids. Of these, four hospitals were chosen initially, later expanded to seven. Thus, it is clear that many hospitals can work jointly with their medical staffs to develop a single bid.

Without question, significant data are required on the applicant's part to establish a bid for all services. The Health Care Financing Administration also requires all hospital and physician bills associated with previous discharges from applicants in order to evaluate the discounts being offered and how they relate to average payments elsewhere in the local market. Fortunately, HCFA's new 100 percent claims files support such detailed evaluation.

Finally, through a series of follow-up questions, hospitals and physicians were able to answer many detailed questions relating to quality assurance, components of the bid price, what services and specialties were covered, the definition of related readmissions covered under the global rate, and similar technical questions. All successful applicants were also willing to forego any outlier payments and balance billing; thereby bearing all the risk for costly cases.

Implementation Issues

Major changes in reimbursement methods were required under the demonstration. First, hospitals and physicians were prohibited from billing their Fiscal Intermediaries and Carriers. Instead, they had to assemble a package of bills and submit them to HCFA Central Office for payment. For payment, the package had to include the hospital discharge abstract plus the three principal physician bills (surgeon, anesthesiologist, and cardiologist).

Hospitals, in order to avoid double billing carriers, had to identify prospective demonstration patients as soon as possible. It is often several days before an inpatient is operated on. During this time, many physician consultants may have seen the patient and already billed for services rendered. Hospitals developed elaborate identification protocols to avoid most of these situations, but in some cases they still must reimburse carriers for overpayments.

Determining the patient's obligation was a challenge. The government decided that every patient discharged in the same DRG from the same demonstration hospital should be liable for a fixed coinsurance amount, after paying any outstanding deductibles. Ordinarily, patient responsibilities vary depending upon the number and kinds of physician and supplier services they use while an inpatient. Developing a fixed actuarial amount was a challenge in determining a typical bundle of physician services. Even more difficult was the hospital's task of collecting the fixed obligation from third-party supplemental insurers.

Volume Growth

Over the first two and a half years of the demonstration, the two nonacademic medical

centers experienced statistically significant increases in Medicare bypass market shares. University Hospital in Boston had a significant decrease in its share while Ohio State University Hospital had no change in market share. Among the three new participants who were under the demonstration for only the last 8 months of 1993, St. Vincent's Hospital in Portland experienced a significant increase in market share prior to entering the demonstration while Methodist Hospital in Indianapolis had a decline in market share.

All seven hospitals exhibited DRG proportions that differed from their local competitors. Hospitals in Atlanta, Boston, Portland, and Houston had disproportionately more DRG 107 referral patients than their competitors, implying that they serve more as referral institutions. (DRG 107 patients have had their angiography completed on a separate admission, usually at another hospital.) Hospitals in Columbus and Ann Arbor had remarkably high proportions of cases in DRG 106 compared to their competitors. Both nonacademic medical centers in the original demonstration group saw significantly fewer minority patients than did their competitors.

When all competitor hospitals were pooled across sites, St. Vincent's in Portland had stays that averaged 3.6 fewer inpatient days; St. Joseph's Hospital in Atlanta averaged 3-day shorter stays. This was true controlling for DRG mix and patient age and gender. Compared to their own set of competitor hospitals, both St. Joseph's hospitals in Atlanta and Ann Arbor had stays roughly 1.5 days shorter on average. All seven hospitals exhibited strong declines in lengths of stay ranging from one-half to one full day per year. Only University Hospital, however, had declines in stays that exceeded the downward trend taking place among local competitors.

Program, Beneficiary, and Hospital Cost Savings

From the start of the demonstration in May-June, 1991, through December, 1993, the Medicare program saved $15.3 million on bypass patients treated in the four original demonstration hospitals. The average discount amounted to roughly 14 percent on the $111 million in expected spending on bypass patients, including a 90-day post-discharge period. Ninety percent of the savings came from HCFA-negotiated discounts on the Part A and B inpatient expected payments. Another 8 percent came from lower-than-expected spending on post-discharge care, while 2 percent came from shifts in market shares in favor of lower-cost demonstration facilities.

In addition, beneficiaries (and their insurers) saved another $2.3 million in Part B coinsurance payments. Thus, total Medicare savings are estimated to have been $17.6 million in 2 1/2 years.

St. Joseph's Hospital in Atlanta generated $5.5 million in program savings; the most of any hospital. Of this total, $4.2 million came from negotiated discounts and another $1 million from post-discharge savings. Savings from its gain in market share were quite minor. University Hospital and St. Joseph's Hospital in Ann Arbor both generated $3.4 million in savings. Ohio State University Hospital generated $2.9 million in savings, the least of the original four hospitals, in spite of the fact that it had by far the largest negotiated inpatient discount per case (roughly $10,000 including teaching costs and other pass-throughs). It also saw the fewest demonstration patients.

The demonstration clearly saved the program money, but what about hospitals that offered discounts to participate? Did the

alignment of physician and hospital incentives result in less costly care as well as lower program costs? Three of four original hospitals were able to make major changes in physician practice patterns and hospital operations that generated significant cost savings. St. Joseph Mercy and St. Joseph's Hospitals, along with University Hospital in Boston, experienced absolute decreases in per case costs ranging from 2 percent to over 23 percent between 1990 and 1993, depending on DRG and hospital. The Atlanta hospital had the highest average reduction: 9-13 percent per case in the two DRGs. Assuming 5 percent annual inflation in hospital input wages and other prices, one could expect a three-year increase of over 15 percent, not counting the secular trend towards more intensive care of older patients with more coronary vessel disease. Thus, the reductions in real resource costs in three hospitals may have ranged between 18 percent and 40 percent. Ohio State University Hospital, by contrast, experienced average cost increases in both DRGs of 10 to 24 percent. After adjusting for expected inflation, however, these rates are not exceptionally high.

The three hospitals with declines in average costs experienced statistically significant declines of 10-40 percent in direct ICU and routine nursing expenses. The two nonacademic medical centers also had significant declines of roughly 30 percent in pharmacy costs per case. Laboratory costs fell between 20 and 60 percent. Operating room costs, by contrast, rose 10-20 percent across all institutions, but, again, this is not controlling for wage and other price increases.

Declining costs per case in Atlanta resulted in increases in average margins of $3-4,000 from 1990 to 1993. St. Joseph Mercy achieved an $8,500 increase in DRG 106, although margins fell by $1,300 in DRG 107 even though costs fell slightly. Ohio State University Hospital experienced major declines ($7,000-$10,000) in average per case margins due to a combination of sizable initial discounts to HCFA, no updates for three years, and 10-24 percent increases in per case costs.

Average margins reflect long-run profitability per case. What is more important to financial managers is short-run profitability based on variable margins. A demonstration patient will be profitable if payment more than covers the additional costs incurred plus contributing something towards fixed costs. On this basis, all four original demonstration hospitals enjoyed significant positive variable margins. St. Joseph's Hospital in Atlanta increased its variable margins by 80-111 percent while St. Joseph Mercy in Ann Arbor increased its DRG 106 variable margin by 62 percent. By contrast, the two academic medical centers saw their variable margins decline by 12-19 percent in University Hospital and 45-68 percent in Ohio State University Hospital.

Patient Outcomes

By the end of 1993, over 3,500 discharges were available for testing demonstration effects on clinical outcomes. (Several hundred more cases were available from the three new hospitals, but they were excluded from most analyses due to the short time they were in the demonstration.) Holding many patient risk factors constant, no statistically significant trend in inpatient mortality rate was found. While a one percentage point reduction in Medicare inpatient mortality exists in the national claims data, it was not possible to adequately risk-adjust this estimate for comparison. The four demonstration hospitals also had much lower overall inpatient mortality rates (4.1-4.9 percent averaged over 1991-93) compared with the national rates (6.5 percent in 1990; 5.5 percent in 1993). One of the four

hospitals was found to have significantly reduced its inpatient mortality rate over the course of the demonstration. Individual trends in the other three hospitals were statistically insignificant.

No statistical difference was found in the overall inpatient mortality rates of the four hospitals regardless of whether patient severity and other risk factors were controlled for. Key risk factors controlled for included whether the patient had had a previous bypass, in which case the risk of dying was 4.5 times higher, whether he/she required the insertion of a balloon pump, thereby tripling the risk of dying, or if he/she was admitted on an emergency basis (2.4 times more likely to die), or over 80 years old (2.5 times more likely to die), or being admitted with renal disease (2.2 times more likely to die). Over the course of the demonstration, there was some evidence of a growing severity in case mix, including a higher percentage of patients over 80 and with comorbid conditions.

Using one-year follow-up information on a subset of patients discharged through December, 1992, no trend was found in the likelihood of dying within one year, controlling for other inpatient risk factors.

Multivariate analysis also showed a significant impact of post-operative complications on inpatient mortality rates. Renal failure, for example, increased the risk of dying by over 8-fold while return to the operating room for bleeding tripled the likelihood. These complications, naturally, were only controlled for after interpreting the trend and hospital differences separately. A significant, positive, trend in the rate of complications was found over the demonstration period (at the 10 percent confidence level). This was true controlling for patient risk factors. Nevertheless, this did not produce an upward trend in mortality. It is also quite likely that most patient complications are outside the hospital's and surgeon's control and may have been increasing in frequency due to unmeasured changes in patient severity.

Appropriateness of Care

Under the assumption that no demonstration patients were candidates for angioplasty, 97.7 percent of the bypass operations among all seven hospitals fell into the appropriate range according to the criteria of an expert panel of surgeons and cardiologists. If every patient were considered a candidate for angioplasty, then only 72.7 percent of operations would have been deemed appropriate; the rest being equivocal or inappropriate. Alternatively, .1 percent of patients could be considered inappropriately operated on if not a candidate for angioplasty versus 3.7 percent if all were candidates.

Given available clinical information, it was impossible to classify patients as to whether they could have undergone angioplasty. However, it seems reasonable to assume that the majority were not candidates. First, each participating hospital has a very active, growing, invasive cardiology service. All surgeons admitted that they were losing patients to angioplasty and that the severity of the patients they were operating on was increasing as a result. Second, almost a quarter of patients had significant left main disease which is generally not considered treatable by angioplasty. Another 50 percent had triple-vessel disease which, although treatable by angioplasty, is still considered best treated by surgery in many cases. Nevertheless, the striking difference in the percentage deemed appropriate under alternative assumptions leaves open the possibility of differences. It was also disappointing that 22 percent of cases could not be classified due to missing data on exercise stress tests, disease anatomy, or ejection fraction. Practically all of the asymptomatic patients (roughly 4 percent of the entire sample) had to be dropped from the appropriateness analysis due to missing data on stress tests and ejection fractions.

No significant time trend was found in the overall average appropriateness rating of

patients discharged from the four original hospitals, regardless of whether they were candidates for angioplasty or not. A slight downward trend in appropriateness was found among patients with unstable angina, left main, and 3-vessel disease. Any trends, however, remained well within a clinical margin of error in quantifying appropriateness.

Statistically significant differences were found in the average appropriateness level among the four hospitals but were of little clinical relevance due to their small absolute size. With nearly 3,000 observations, almost any difference was likely to be significant.

Coronary angiography results are one of the major determinants of the choice of treatment for coronary artery disease as well as the overall necessity of intervention. A separate, blinded, evaluation of 119 angiogram films from six of seven hospitals in 1993 found that hospitals' estimates of the extent of stenosis, or occlusion, was significantly greater than those based on quantitative angiography. Hospitals' visual estimates were also 6-15 points greater (on a scale of 1 to 100) than the expert visual estimates. Multivariate analyses showed one hospital consistently understated the degree of stenosis by 10-15 points relative to other participants. Two other hospitals were 5-8 points lower than the three hospitals with the highest overestimates.

Hospitals' overestimates varied inversely with the degree of stenosis, with more accurate readings at higher levels of occlusion. Angiographic quality was poor in 5-35 percent of cases depending upon hospital. Moreover, many catheter reports were incomplete with respect to clinical indications for catheterization, type of contrast agent, number of catheters used, etc.

Patient and Hospital Management

Three of four original demonstration hospitals made major improvements in their micro-cost data systems. A fourth hospital remained on the traditional departmental cost-to-charge system of patient cost finding. This caused serious problems working with surgeons in trying to change practice patterns. Only where hospitals could link specific services to patients and attach meaningful direct costs to them were they able to convince physicians of the need for more cost effective decision making. Hospitals with detailed cost systems were able to conduct special studies in the operating room, the pharmacy, the ICU, and the catheter lab, that showed surgeons the frequency of brand and generic drugs, costly angiographic agents, etc.

Interestingly, few of the financial managers closely monitored the cost and profitability of demonstration patients. Rather, they hired an outside consultant to work with surgeons to change practice patterns. Comparative data from other hospitals provided by the consultant seemed crucial in supporting cost-effective drug substitutions and reductions in resource use.

A primary focus was the four components of length of stay: admission to catheterization; catheterization to surgery; ICU length of stay; and post-ICU length of stay. As a result, most hospitals reduced ICU stays by one full day and routine stays by another two days.

Hospital managers also noted that the best costing system was of limited use without the surgeon's active involvement. Aligning surgeon with hospital incentives to reduce costs was absolutely critical in changing practice patterns and improving department efficiency. In the one hospital without a micro-cost system, the surgeons resisted practice changes and little was accomplished during the first two years of the demonstration. (Other barriers to change are summarized below.)

The two nonacademic institutions made major staffing reductions over the course of the demonstration in response to declining inpatient utilization. Shorter ICU stays meant

more turnover and fewer nursing days per patient. Early extubation and quicker ambulation were key factors.

Hospitals also introduced a major innovation by designating Clinical Nurse Specialists to be in charge of each bypass patient's stay. Their main job was to assure a smooth transition from service to service, to avoid costly complications, and to improve communications among specialists making clinical decisions. They also reviewed standing orders and recommended changes. It is interesting that specialists in other areas such as orthopedics resisted hospital attempts to introduce nurse specialists. Managers felt that they had no financial incentives to change their practice patterns.

Another novel change was the implementation of same-day surgery for DRG 107 patients. Again, physician incentives to avoid an extra day's stay helped, although many now seem challenged to get patients in and out of the hospital as quickly as possible regardless of payment methods. Nurses argued that changing both physician and patient mindsets about how long they would be staying was key; that several days were unnecessary in the recuperation process and were better spent at home.

Pharmacists cited several drug substitutions that explained the savings reported earlier. One hospital reported saving $50,000 annually in cardioplegic solutions during surgery. Two other hospitals were saving $100,000 per year by substituting generic for brand narcotics. Twenty to forty thousand dollars was saved in vasopressors, anti-coagulants, and diuretics at a couple of participating hospitals. Pharmacists emphasized the importance of having the surgeon on their side, inviting them to meetings, discussing possible substitutions, asking for special studies.

Operating room managers observed a significant increase in the complexity of bypass surgery which they ascribed to angioplasty and fewer single and double-vessel bypasses. Nevertheless, they saw improvements in operating room times. Bypass operations that used to take 8.5 hours in 1992 were taking 5 hours in 1994, for example. Due to improvements in angioplasty, none of the hospitals kept an operating room and team standing by for failures. Now, it is on a next-available basis.

Efficiencies have been realized in the catheter lab as well, beginning with the substitution of ionic for nonionic contrast agents. One hospital saved $500,000 annually by using the cheaper agent half the time, without adverse reactions. With the cardiologists' support, managers have been able to narrow the number of device vendors from seven to two, thereby increasing their negotiating power and getting greater discounts.

Marketing Programs and Local Competition

Competition increased markedly in all four market areas, according to both demonstration managers and local competitors. First, hospitals could no longer rely on cost-based reimbursement. Second, managed care plans were very active in all four areas. Third, the diffusion of new catheter labs were having profound effects on referral patterns. And fourth, a few local competitors were being very aggressive in their marketing and networking with local physicians.

All four hospitals engaged in direct patient advertising, but emphasized quality, not lower price. This was particularly true of the nonacademic medical centers who concentrated on building a national reputation (and succeeded). The imprimatur of being a Medicare Heart Bypass Center was marketed heavily as a quality indicator to reassure patients when referred by physicians or managed care plans to their facility. By contrast, the academic medical centers found themselves switching marketing strategies away from the "pursuit of science "to a" caring environment".

The two nonacademic medical centers, as well as like competitors, were very active building referral networks. Deans in a couple of the academic hospitals, by contrast, were slow to react to the changing heart market and continued to espouse a "they will come" philosophy. Finally, when volumes dropped precipitously, surgeons and marketing staff convinced them to emphasize clinical care much more. Still, building referral networks for academic hospitals is difficult because of the tensions surrounding admitting privileges and lack of outside physician access to patients once admitted.

All four hospitals felt they were in a much better position to negotiate managed care contracts because of the demonstration. "We have expensed the experience," as one manager put it, implying that the hospital was forced to make the front-end investment in data systems, physician relationships, billing and collection systems, and critical care nurses that was now being put to use in the private market. The two nonacademic medical centers, again, had negotiated several global heart contracts with Delta, Prudential, and Aetna in Atlanta, and with First American Bank, and Consumers' Power in Ann Arbor. Weak data systems, high teaching costs, HMOs seeking full service contracts, and even resistant surgeons, held back the academic medical centers in negotiating bundled rates for heart care.

Interviews with managers and surgeons of academic medical centers, both in and out of the demonstration, highlighted major obstacles in a global budget environment. First, and foremost, they have a teaching and research mission and a cumbersome bureaucracy to overcome in responding to a fast-moving market. Closed staffs, limited operating room time, inefficient residents, very costly overhead services, impersonal community image; all constrain how far they can go towards expanding the clinical side of their operations. Years ago, these hospitals were totally dominant in their markets for complex bypass surgery. Today, many nonacademic hospitals are performing bypass surgery and angioplasty. Academic reputation alone is not enough to assure a viable number of bypass patients. Their far-flung referral networks were shrinking as new providers opened up around the state, forcing them to concentrate their marketing efforts locally. Finally, some academic surgeons are not anxious to compete for patients by changing practice patterns and lowering costs, which they see interfering with their teaching obligations. This raises the question of who will pay for teaching under a comprehensive managed care system of global budgeting.

Physician Payments

The negotiated global price between the government and the participants was based on separate estimates of Part A hospital and Part B physician outlays. Bidders then discounted each component either across the board or differentially by category. All four original hospitals began allocating the single payment according to amounts agreed-upon in their bid. The four major specialties always involved in a bypass admission, namely, the surgeon, the anesthesiologist, the cardiologist, and the radiologist, all received fixed capitated amounts regardless of the services provided different patients. Consulting physicians were paid their regular allowable Medicare fees out of a set-aside pool in the Part B component. A percentage holdback on payments to the four capitated physicians was used to pay these fees. Any savings on the pool at year's end were returned to them.

The fact that consulting physicians could not bill Medicare directly proved contentious in several sites. Surgeons also cut back on their use of consultants, which aggravated them even more. In one site, pulmonologists,

neurologists, and other consultants alleged that the quality of care was being compromised. When hospital management asked that they provide evidence of poorer quality, they were unable to do so.

As the demonstration progressed, two important changes took place in physician payments. First, the Congress introduced the Medicare Fee Schedule which had the effect of reducing HCFA payments on the Part B component of the bundled payment. No hospital adjusted their physician payments for the reduction; hence, physicians under the demonstration were effectively sheltered from RBRVS rollbacks on bypass surgery, catheterization and other overpriced procedures. Hospitals also made some minor adjustments in radiologists' payments (downwards) and cardiologists' payments (upwards) for technical reasons or errors in original estimates.

The second change in physician payments came from sharing in hospital cost savings in the two nonacademic medical centers. In Ann Arbor, St. Joseph Mercy "shared" the savings it realized from changes in surgeon practice patterns by extending them more operating room time and by converting their physician assistants in surgery and nurse specialists into hospital employees. In Atlanta, St. Joseph's Hospital instituted a Cost Reduction Allocation Program that provided bonuses to individual surgeons based on documented savings to the institution. To be eligible, the surgeon had to meet stringent quality and volume criteria. The bonus formula assured every surgeon of receiving at least the originally negotiated payment, thus insulating them from RBRVS rollbacks, plus one-quarter of any hospital cost savings they personally generated.

A final benefit to physicians was the willingness of each hospital to take responsibility for collecting any deductible and coinsurance amounts on both Part A and B. In general, physicians were paid promptly by the hospital upon discharge or within two weeks, except for late billers. Delays of several months in collecting the coinsurance from supplemental insurers resulted in significant cash flow problems for hospitals instead of physicians.

Reimbursement Difficulties

The demonstration involved major changes in reimbursement arrangements. First, providers had to bundle all physician inpatient bills with the hospital bill and submit them to HCFA Central Office for payment. No physician could bill carriers for inpatient services provided demonstration patients. Second, HCFA developed a flat copayment for each patient by hospital and DRG.

According to providers, patients were quite pleased with a single copayment amount. This simplified the payment process. They also liked the idea of a bundled copayment amount for both hospital and physician services.

Hospitals, in general, were also pleased with the prompt payment received by HCFA Central Office, which was done by wire within thirty days. The one difficulty with came with delays in updating rates for the Medicare Fee Schedule in the first quarter of 1994. Instead of continuing to pay under the old rates, HCFA stopped paying any discharges from January through mid-April until it established the new rates. This created a cash flow problem of several million dollars until it was resolved.

Supplemental insurers responsible for paying patient deductible and coinsurance amounts were uniformly displeased with the flat actuarial payment calculated by HCFA. It was incompatible with their computer systems that required itemized charges, services, and payments by CPT code. Also, patients differed in their policies in terms of coverages, deductibles, and coinsurance amounts. A flat rate assumed all patients had identical supplemental policies. Many insurers also wanted to pay

less when their patients used fewer physician services. In fact, the Medicaid programs in Michigan and Ohio refused to pay any amounts based on the flat rates for joint Medicare-Medicaid eligibles, arguing that their fee schedule was less than the flat rate. One insurer captured the feelings of many others by noting that "we didn't agree to participate in the demonstration". While the government has made extraordinary efforts to explain the change to insurers, it still regards the supplemental payment issue to be a provider problem. In fairness, HCFA explicitly adjusted the Part A and B amounts of the global payment so as to underestimate the average patient obligation.

Certainly, the single largest administrative burden for hospitals under the demonstration involved billing and collection. Every site significantly underestimated both the effort to assemble a complete package of bills and invoice the government as well as trying to collect the supplemental insurance. HCFA, the sites acknowledged, made many concessions and contacted many insurers, but the reimbursement changes inevitably required a whole new layer of billing/collection staff and procedures. As costly as it was, one financial manager considered it "expensed experience" that had to be made in order to win private sector contracts of a similar nature.

Achievement of Goals

Overall satisfaction with the demonstration was mixed. Some goals were achieved, some were not. Some hospitals were more successful than others. All sites were hoping to increase their bypass volumes and market shares. The two nonacademic hospitals were quite successful while the two academic centers had either constant or declining market shares. The failure to increase volumes at Ohio State University Hospital was particularly distressing given the large discounts they negotiated. Several hospitals felt that the government had abandoned them by not actively promoting the demonstration or allowing them to waive patient copayments for the uninsured.

On the positive side, three of four hospitals did sign major new private managed care contracts bundling payment of heart surgery. Most had made the necessary investments in data systems, joint physician contracting arrangements, changes in practiced patterns, and new billing systems. The one hospital that failed to make data investments had major contracting problems with their physicians.

Certainly, the most salient accomplishment of the demonstration was the reduction in hospital costs in three of four hospitals. As one demonstration manager put it, "we set a target of reducing our bypass costs by $1,000, and we did it." While a goal in most hospitals, there was some skepticism that physicians would change their practice patterns. Everyone in three hospitals were surprised at how quickly and how dramatically physicians were able to reduce lengths of stay, substitute generic for brand drugs, and reduce unnecessary testing and other services. In this regard, surgeon support for the clinical nurse specialists implementing critical pathways was crucial. In the one hospital where surgeons resisted attempts to change practice patterns, costs continued to rise.

Another goal of hospital staff was to achieve a closer working relationship with their physicians. All four hospitals felt they had achieved this goal, although tensions remain in some places with surgeons and consulting physicians. Aligning physician and hospital incentives, respondents agreed, was key to the change in attitudes.

Although quality improvements were never an explicit goal--all four hospitals felt they were providing high quality already--nurses in a couple of institutions believed that quality had improved. The primary reason was the

increased emphasis of surgeons and other physicians on avoiding complications. The fact that complication rates rose slightly during the demonstration is inconsistent with their subjective impressions, however, and may be due to changes in coding or unmeasured increases in patient severity.

The one uniform disappointment was the difficulties encountered in billing and collection. All sites felt they should have received extra payments to cover the novel billing arrangements. Now that internal procedures and computer systems are in place, however, these sunk costs are felt to be outweighed by enjoying the continuing imprimatur of being a Medicare Heart Bypass Center.

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